

Etiology and Pattern of Zygomatic Complex Fractures: a Retrospective Study

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Purpose: To document the etiology and clinical data of patients with fractures of the zygomatic complex seen in two university teaching hospitals in Nigeria and to compare the findings with other studies in the literature.

Patients and Methods: A six-year retrospective study involving 134 patients with zygomatic complex fractures. These patients were selected from a pool of 960 patients who sustained maxillofacial fractures during the period under review. Recorded were demographic, etiologic and clinical data as well as radiologic findings, treatment and postoperative complications. The Chi-squared test was used to test for significance and p values <0.05 were regarded as significant.

Results: 76.1% were males and 23.9% females. Most (46.3%) patients were aged 21–30 years and road traffic accidents (82.1%) caused the most injuries ($p<0.05$). Regarding the site of fracture, 88.8% of the patients had fractures of the zygomatic bone, 8.2% had fractures of the arch, and 3.0% had fractures of both the zygomatic bone and arch. The most frequently associated maxillofacial fracture was mandibular (21.0%). The commonest clinical feature was subconjunctival ecchymosis (63.4%), while the commonest radiologic findings were fractures at the zygomatico-frontal and zygomatico-maxillary sutures (38.8%). The Gillies approach (23.4%) was the commonest method of reduction.

Conclusion: This study has shown that road traffic accidents are responsible for most zygomatic complex fractures in our environment. Urgent enforcement of road traffic legislation is therefore necessary to minimize zygomatic complex fractures due to road traffic accidents. It also showed a low utilization of technological advances in the imaging and treatment of these fractures. These may play a role in the frequency of postoperative complications.

Key words: zygomatic complex ■ fractures ■ etiology ■ pattern

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INTRODUCTION

Fractures of the zygomatic complex are among the most frequent in maxillofacial trauma.^{1,2} The zygomatic complex is responsible for the mid-facial contour and for the protection of the orbital contents.³ The etiology of zygomatic complex fractures include road traffic accidents, assaults, falls, sports and missile injuries.^{4–9} The relative contribution of these factors varies from region to region.^{6,9}

Fractures of the zygomatic complex appear commoner in young adult males.^{7,9–11} Common clinical features of zygomatic complex fractures include diplopia, enophthalmos, subconjunctival ecchymosis, flattening of the cheek, gagging of the occlusion and sensory disturbances.^{3,8,12–14} Diagnosis of zygomatic complex fractures is usually clinical, with radiographic confirmation.¹⁵

Although isolated zygomatic complex fractures occur, several studies have shown that fractures of the zygomatic complex are often associated with other maxillofacial injuries.^{4,16,17} It would appear that there is no consensus opinion regarding the management of zygomatic complex fractures, as some studies have shown that many maxillofacial surgeons utilize differing practices in the management of such fractures.^{18–21}

This study aims to determine the etiology and pattern of fractures of the zygomatic complex as seen in two university teaching hospitals in southern Nigeria and to compare the findings with other studies in the literature.

PATIENTS AND METHODS

Over a six-year period (January 1997 to January 2003), 134 patients with fractures of the zygomatic complex were retrospectively studied at the University of Benin Teaching Hospital (UBTH), Benin City, and the Obafemi Awolowo University Teaching Hospital (OAUTH), Ile Ife—both in Southern Nigeria. These patients were selected from a pool of 960 patients who sustained maxillofacial fracture during the period under review. Data documented were the

patients' age, sex and etiology of the fracture. Other data recorded were the site of fracture (zygomatic bone or arch), associated maxillofacial injuries, clinical presentation, radiographic findings, treatment, duration of follow-up and complications. Descriptive statistics and statistical analysis for significance were performed with the SPSS version 6.0, Chicago, IL. Statistical testing was done with the Chi-squared test. P values less than 0.05 were regarded as significant.

RESULTS

One-hundred-two (76.1%) males and 32 (23.9%) females were recorded during the study period, giving a male:female ratio of 3.2:1. They ranged in age from 18–70 years, with a mean age of 32 years. Patients in the 21–30-year age group (62 or 46.3%) were most often involved (Table 1). The etiology of zygomatic complex fractures are shown in Table 2. There was a significant association between road traffic accidents and fractures among the age groups ($\chi^2=38.919$, $df=24$, $p<0.05$) but none between road traffic accidents and sex ($\chi^2=3.574$, $df=3$, $p>0.05$).

One-hundred-nineteen (88.8%) patients sustained fractures of the zygomatic bone, 11 (8.2%) had fractures of the zygomatic arch and four (3.0%) patients had fractures of both the arch and the zygomatic bone. There was a significant association between fractures of the zygomatic bone and road traffic accidents ($\chi^2=35.519$, $df=6$, $p<0.001$). Fifty-nine (44.0%) patients sustained other maxillofacial fractures (Table 3). There was no significant association between these fractures and age ($\chi^2=18.714$, $df=12$, $p>0.05$), sex ($\chi^2=5.855$, $df=4$, $p>0.05$) or site of zygomatic complex fracture ($\chi^2=2.053$, $df=4$, $p>0.05$).

The presenting features of zygomatic complex fractures are shown in Table 4, and Table 5 shows the radiographic views requested for diagnosis of these fractures. The radiological findings are shown in Table 6. The majority 113 (84.3%) of fractures were treated under endotracheal general anesthesia. Eight (6.0%) were treated under local anesthesia and intravenous sedation. In 13 (9.7%) patients, no active treatment of the fracture was performed (Table 7).

Table 1. Age and Gender Distribution of Patients

Age Range (Years)	Male (No)	Female (No)	Percent
11–20	7	6	9.7
21–30	46	16	46.3
21–40	27	6	24.6
41–50	16	4	14.9
51–60	2	–	1.5
61–70	4	–	3.0
Total	102	32	100

The approaches and methods of management of zygomatic complex fractures are shown in Table 7. The Gillies approach in 34 (25.4%) was the commonest method of reduction. The upper buccal sulcus approach was used in only one (0.7%) patient. Where internal fixation was required, transosseous wiring with 0.5 mm diameter soft stainless wire was performed. The duration of follow-up ranged from four weeks to two years. The following postoperative complications were recorded—blindness in four (3.0%), persistent flattening of the cheek in four (3.0%), and persistent enophthalmos in one (0.7%).

DISCUSSION

The UBTH and OAUTH have a combined capacity of over 1,000 bed spaces. Both have oral and maxillofacial surgery departments dedicated to the teaching of undergraduate students and residents, and the management of orofacial conditions. They are also major trauma referral centers. This study recorded that more males than females (ratio 3.2:1) sustained zygomatic complex fractures. This is consistent with other reports.^{22–24} Males (34.3%) in the 21–30-year age group were most often involved, and road traffic accidents were the leading etiologic factor ($p<0.05$). Many studies have shown that young adult males were commonly affected.^{7,9,10,23} The role of road traffic accidents as an etiologic factor in zygomatic complex fractures has been identified by some studies.^{2,6,15,17,23} A previous study had identified the contributory factors in road traffic accidents resulting in maxillofacial trauma in Nigeria.²⁵ The young Nigerian male is more likely to engage in jobs that require intercity vehicular transport. Due to nonenforcement of road traffic laws, many Nigerian drivers notoriously exceed the speed limit, do not use seat belts, and drive under the influence of alcohol and other psycho-active substances. As a result of the economic recession in Nigeria, many drivers fit already used tires on their vehicles, while years of neglect have left the highways in disrepair. All these factors contribute to the rising role of road traffic accidents as a leading cause of maxillofacial trauma in Nigeria.²⁵

The present study recorded more fractures of the zygomatic bone (88.8%) than those of the arch

Table 2. Etiology of Zygomatic Fractures

Cause	Number	Percent
Road traffic accidents	110	82.1
Missiles	12	9.0
Assault	6	4.5
Falls	5	3.7
Sport	1	0.7
Total	134	100

(8.2%) or combined zygomatic bone and arch (3.0%). Isolated fractures of the arch are uncommon.⁶ This was probably because of the predominant role of road traffic accidents, in which most impacts to the face were most likely frontal. Arch fractures are more likely to involve some form of lateral impact and were more often encountered in cases of missile injuries, assaults and sport in this study.

As a result of the intimate association of the zygomatic complex with the rest of the facial skeleton, associated maxillofacial fractures are common. The findings from this study are similar to the associated facial bone fractures seen in patients with fractures of the zygomatic complex reported by Afzelius,⁴ Ellis et al.²² and Nam.²⁶ These studies^{4,22,26} showed that mandibular fractures were most often associated with zygomatic complex fractures.

Although several signs and symptoms accompany zygomatic complex fractures,^{3,6,13,26} not all require active treatment. Circumorbital ecchymosis and subconjunctival ecchymosis were most frequently encountered in this study but were usually self-limiting. Banks and Brown⁶ have summarized the indications for treatment as follows: to restore the normal contour of the face both for cosmetic reasons and to establish skeletal protection for the globe of the eye, to correct diplopia and to remove any interference with the range of movement of the mandible. Flattening of the cheek was encountered among 47.8% of patients in the study. This is usually seen in tripod fractures that are most often displaced inwards to a greater or lesser extent.⁶ Diplopia was observed in 9.7% of patients in this study. Al-Qurainy et al.¹³ reported diplopia in 19.8% of patients with mid-face fractures and found that zygomatic fractures were a principal risk factor in the development of diplopia.¹³ Limitation of mandibular movement occurred in 56% of patients and is usually a result of the fractured zygomatic complex impinging on the coronoid process of the mandible.⁶

Radiographic examination in fractures of the zygomatic complex appears somewhat unresolved. In the 1994 survey¹⁸ of British oral and maxillofacial surgeons, 93.3% of respondents use two or more

radiographs for diagnostic purposes. Only 6.7% of surgeons would rely on a single radiograph for diagnosis.¹⁸ This is similar to the findings in this study where in 73.1% of the cases two or more radiographs were requested for diagnosis. In only 25.4% of the cases was one radiograph requested. Earlier, Ogden et al.²⁷ had proposed that in some fractures of the zygomatic complex, clinical criteria alone were sufficient for postoperative assessment. Pogrel et al.²⁸ evaluated the efficacy of a single radiograph to screen for mid-face fractures and concluded that a single 30° occipitomeatal radiograph (augmented with CT scans when indicated) can identify all mid-face fractures requiring treatment. In this study, only 12.7% of patients had postoperative radiographs taken. The most frequent radiologic findings were fractures at the ZM and ZF sutures (38.8%). The suture lines of the zygomatic complex are the weak points of the bone, as it is unusual for the zygomatic bone itself to be fractured.⁶

The Gillies temporal approach (25.4%) was the commonest method of reduction. This is consistent with other reports.^{18,24,26} In grossly displaced fractures, rigid fixation was obtained with transosseous wires and fixation at the ZF suture was most common. This is consistent with an earlier report.²⁹ There was no use of miniplates in this study, their use being limited by nonavailability. McLoughlin et al.¹⁸ found that the use of the bone plating was not significantly greater than the use of transosseous wiring among British oral and maxillofacial surgeons.¹⁸ However, Tadj and Kimble,³⁰ in a study of 263 cases of fractured zygomatic complex, found that bone plating was the most frequently employed fixation.

Most (70%) patients in this study were lost to follow-up. As is common with patients in our study environment, once the acute phase of a medical condition is resolved, they tend to default on appointments. This may be a factor in our reported frequency of postoperative complications. This study found postoperative complications among 6.7% of the

Table 3. Distribution of Associated Maxillofacial Fractures

Fracture Type	Number	Percent
Mandible	22	37.3
Le Fort II	18	30.5
Orbital	8	13.5
Le Fort III	6	10.2
Nasal	5	8.5
Total	59	100

Table 4. Clinical Features of Zygomatic Complex Fractures

Clinical Feature	Number	Percent
Subconjunctival ecchymosis	85	63.4
Circumorbital ecchymosis	81	60.4
Limitation of mandibular movements	75	56.0
Flattening of the cheek	64	47.8
Depression over the arch	8	6.0
Diplopia	13	9.0
Enophthalmos	4	3.0

patients. Covington et al.³¹ reported a complication rate of 1.5%, while Tadj and Kimble³⁰ reported a rate of 20.7%. Blindness is an extremely morbid event and was encountered in 3.0% of patients. In all cases, it was preceded by decreasing visual acuity. In this study, ophthalmic consultation was usually sought for patients with impaired ocular functions. The role of the ophthalmologist in the perioperative assessment of patients with zygomatic complex has been documented.^{32,33}

Zacchariades et al.,³⁴ in an analysis of 5,936 patients with facial trauma, found that vision in 19 eyes were lost in 18 patients. Zygomatic complex fractures accounted for 0.45% of cases. Apart from direct injury to the globe of the eye,³⁴ the mechanism for the devel-

opment of blindness in zygomatic complex fractures is thought to be due to hemorrhage within the muscle cone and ultimately spasm or occlusion of the short posterior ciliary arteries, causing ischemia of a critical zone of the optic nerve.³⁵ Other complications were persistent flattening of the cheek (3.0%) and persistent enophthalmos (0.7%), and these were as a result of inadequate surgical management.

In conclusion, this study has shown that road traffic accidents are responsible for most zygomatic complex fractures in our environment. Urgent enforcement of road traffic legislation is therefore necessary to minimize zygomatic complex fractures due to road traffic accidents. It also showed a low utilization of technological advances in the imaging and treatment of these fractures. These may play a role in the frequency of postoperative complications.

Table 5. Distribution of Radiographic Investigations

Investigation	Number	Percent
Occipitontental + postero-anterior + lateral view	52	38.8
Occipitontental + postero-anterior view	46	34.3
Submentovertex view	21	15.7
Occipitontental view	13	9.7
Computed tomography	2	1.5
Total	134	100

Table 6. Radiologic Findings Associated with Zygomatic Complex Fractures

Radiologic Finding	Number	Percent
Antral opacity	60	44.8
*Fracture at the ZF and ZM sutures	52	38.8
Fracture at the ZF suture only	38	28.4
Fracture at the ZM suture only	30	22.4
V-shaped arch fracture	7	5.2
Comminution of the zygomatic arch	2	1.5
Comminution of the zygomatic bone	1	0.7

* ZF: zygomatico-frontal, ZM: zygomatico-maxillary

Table 7. Approaches and Treatment for Zygomatic Complex Fractures

Treatment	No	Percent
1. Gillies approach	34	25.4
2. Lateral eyebrow approach	23	17.2
3. Upper buccal sulcus approach	1	0.7
4. Fixation at the ZF suture only	23	17.2
5. Fixation at the ZM suture only	14	10.4
6. Fixation at the ZF and ZM sutures	17	12.7
7. No treatment due to financial constraints	2	1.5
8. Antral packing	9	6.7
9. Observation	7	5.2
10. Lost to follow-up	4	3.0
Total	134	100

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